Kaohsiung Journal of Medical Sciences (2011) 27, 242–246

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CASE REPORT

Delayed superficial femoral artery pseudoaneurysm following distal femoral shaft fracture: A case report

股骨幹遠端骨折併發遲發性淺股動脈假性動脈瘤

Sheng-Pin Lo [a], Chih-Chiang Hsieh [b], Chyun-Yu Yang [a], Chii-Jeng Lin [a], Chih-Wei Chang [a,c,*]

羅勝彬 [a], 謝志強 [b], 楊俊佑 [a], 林啟禎 [a], 張志偉 [a,c,*]

[a] *Department of Orthopaedics, National Cheng Kung University Medical Center, Tainan, Taiwan*
[b] *Department of Radiology, National Cheng Kung University Medical Center, Tainan, Taiwan*
[c] *Traumatology, National Cheng Kung University Medical Center, Tainan, Taiwan*

Received 14 July 2010; accepted 13 September 2010
Available online 31 March 2011

KEYWORDS
Delayed;
Fracture;
Percutaneous stent graft;
Pseudoaneurysm;
Superficial femoral artery

關鍵詞
遲發;
骨折;
經皮血管支架;
假性動脈瘤;
淺股動脈

Abstract A 69-year-old man presented with an expanding tissue mass over the medial aspect of his left thigh 6 weeks after a fracture of the distal femur shaft. Imaging studies confirmed a rare traumatic pseudoaneurysm of the superficial femoral artery. For the massive hematoma and persistent exsanguinating hemorrhage, staged interventions were taken. First, the pseudoaneurysm was hemodynamically isolated with an endovascular stent-graft placement. Subsequent surgical exploration and aneurysmectomy were performed later for the evacuation of the formed hematoma and the relief of the resultant compressive symptoms. Because traumatic pseudoaneurysm can have an insidious onset and delayed presentation, surgeons should consider the possible complication even after initial fracture fixation.

摘要 一位69歲男性於左股骨骨幹遠端骨折6周後，在左大腿內側面產生一漸進性腫脹。影像檢查證實此為一少見位於淺股動脈的創傷後假性動脈瘤。針對已形成的血腫與持續、擠壓式滲血，我們採取階段式的介入方式來處理。先以經皮放置血管支架成功地控制假性動脈瘤後；再對巨大血塊與壓迫症狀進行手術探查與清除。因創傷後的假性動脈瘤其初始症狀可能不明顯與常見的延遲表現，外科醫師在臨床診察或追蹤時，即使在骨折內固定手術後仍需留心此一可能的併發症。

* Corresponding author. Department of Orthopedics, National Cheng Kung University Medical Center, No 138, Sheng-Li Road, Tainan 70428, Taiwan.
E-mail address: u7901064@yahoo.com.tw (C.-W. Chang).

1607-551X/$36
doi:10.1016/j.kjms.2010.09.004

Introduction

A pseudoaneurysm or false aneurysm is a collection of blood leaking from a damaged arterial wall; the damage can be caused by traumatic or iatrogenic perforations or failed surgical anastomosis. Because of its common insidious onset and possible delayed presentation, surgeons should always be aware of the implicated lesion even after initial fracture fixation. We report a case of delayed superficial femoral artery (SFA) pseudoaneurysm 6 weeks after osteosynthesis of the broken distal femur and illustrate the importance of suspecting associated vascular injuries after lower extremity trauma.

Case presentation

A 69-year-old man sustained a distal femoral fracture in a traffic accident (Fig. 1); no other significant injuries were noted except the transiently weak peripheral pulses. On the same day, the fracture was operatively treated by closed reduction and stabilization with a 10 × 340-mm retrograde intramedullary nail (S2 Femur A/R Nail; Stryker Trauma, Schönkirchen, Germany). These procedures underwent with the patient supine and with the knee flexed 40° using supportive bumps under the knee. Intraoperative fluoroscopy guided proper reduction and trajectory of the guide pin. Postoperative radiographs revealed a posterior step-off between the proximal and distal fragments; however, a smooth course without functional interference was noted. The patient was discharged with partial weight-bearing ambulation. At an outpatient follow-up 3 weeks after the surgery, a tender swelling over the medial thigh was complained, and subsequent radiographs revealed an ovoid soft tissue mass behind the fracture site. A residual hematoma was impressed, and observation was recommended based on the intact distal pulsation and neuromuscular function. However, even 3 weeks later, the enlargement of the mass continued and associated compressive symptoms developed. A delayed psuedoaneurysm instead of a simple hematoma was suspected. Further investigation, including duplex ultrasound and computed tomographic angiography, confirmed the uncommon lesion originating from the SFA adjacent to the fracture site (Figs. 2 and 3).

After consulting vascular surgeons, we planned a staged treatment course consisting of initial hemodynamic stabilization by pseudoaneurysm isolation, subsequent surgical exploration, and aneurysmectomy. Pseudoaneurysm isolation was achieved by inserting an endovascular stent graft of 6 mm in diameter and 60 mm in length (Fluency; C. R. Bard, Inc., New Jersey, U.S.) at the affected site under local anesthesia (Fig. 4). During surgical exploration 2 days later, the upper fragment with a nearby sharp edge was noted, which was thought to have caused the arterial disruption leading to the hematoma. To prevent recurrence, the reduction of the step-off between fragments by readjusting the internal fixation had been tried and the sharp bony edge was smoothed (Fig. 4). After surgery, the compressive discomforts were quickly relieved, and anticoagulation therapy with Plavix® (clopidogrel bisulfate) was begun. During regular clinical follow-ups over 6 months, intact neurovascular status without recurrent painful swelling or reported complications was observed.

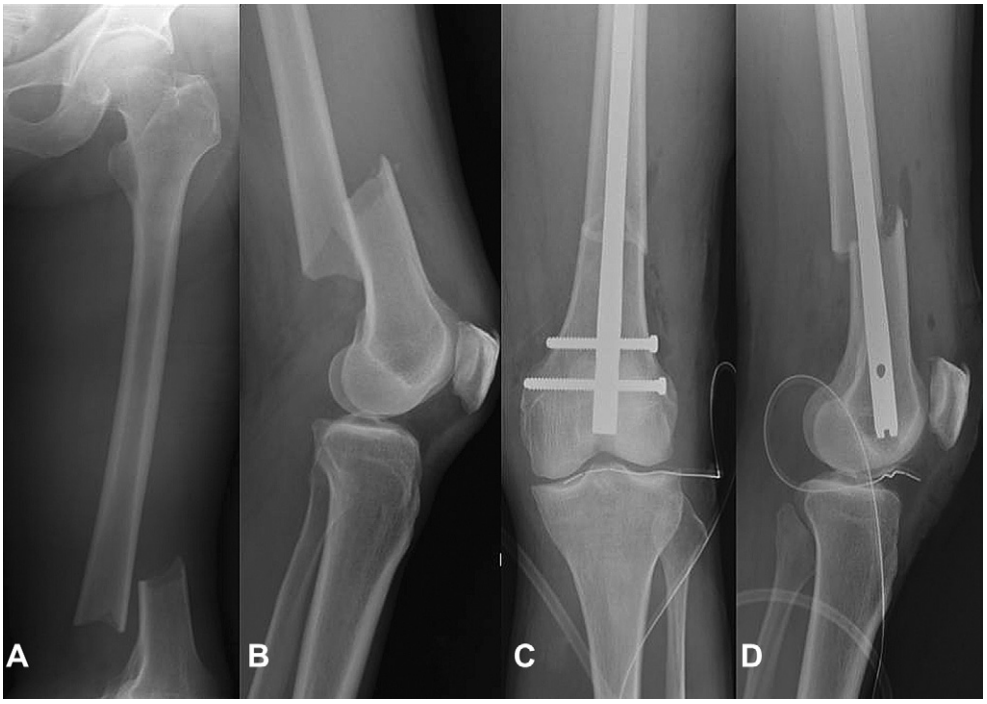

Figure 1. (A) and (B) Radiographs of the fractured distal femur showing a severely angulated and posteriorly translated transverse fracture noted before operation; (C) and (D) after closed reduction and retrograde intramedullary nail fixation, the fracture was restored with suboptimal alignment for residual translation, but no abnormal soft tissue mass was observed at this time.

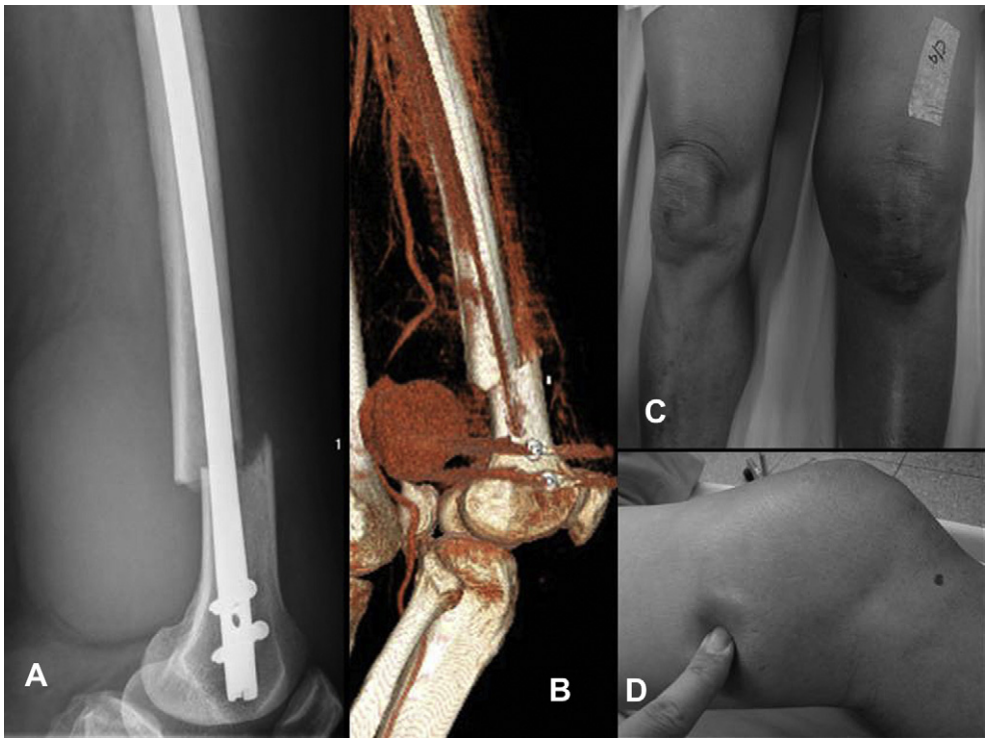

Figure 2. (A) Subsequent radiograph taken 6 weeks after fracture stabilization showing a well-defined enlarging soft tissue mass (13 × 8 cm in size) posterior to the distal femur; (B) reconstructed computed tomographic image demonstrating a huge vascular pouch originating from the adjacent superficial femoral artery behind the fracture site, cause vascular compression; (C) and (D) clinical photographs of progressive posteromedial thigh swelling.

Discussion

For pseudoaneurysm after blunt injury or surgical intervention, the profunda femoris artery is more commonly involved region [1—6]; however, traumatic vascular lesions involving the SFA secondary to femoral fracture were sporadically reported in the literature [7—9].

In traumatic vascular lesions with subtle initial presentation or late detection, it is difficult to determine the timing of insult and the exact cause. Most reported

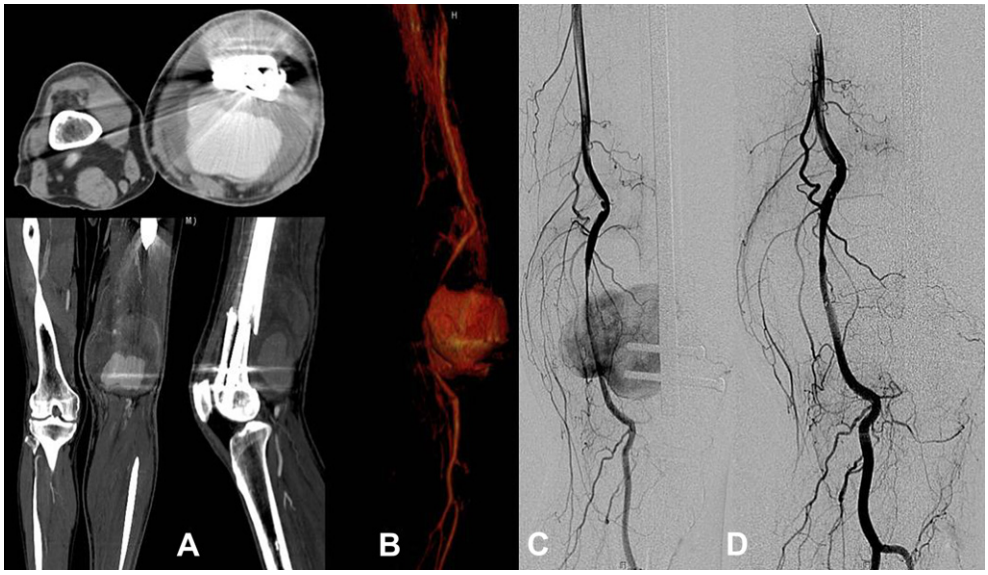

Figure 3. (A) Computed tomographic angiographs showing a huge vascular pouch with contrast pooling anterior to the distal superficial femoral artery; (B) the reconstructed three-dimensional image of vasculature clearly showed that (C) the involved region was compatible with the interventional angiography performed later; (D) extravasation successfully stopped after isolation of the pseudoaneurysm.

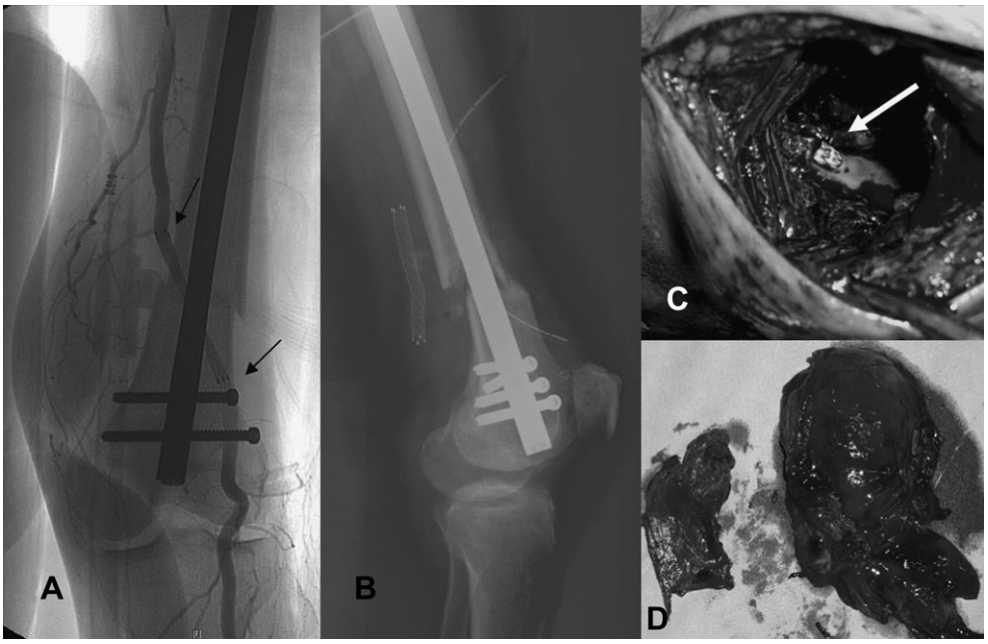

Figure 4. (A) Images obtained after successful isolation of the pseudoaneurysm with a percutaneous stent graft (black arrows); (B) readjustment of the internal fixation had been tried to reduce the translation between fragments; (C) the damaged arterial wall and the stent (white arrow) noted during the following exploration; (D) the excised pseudoaneurysm without real vascular linings.

postoperative complications are caused by penetration of the sharp drill bit or screws during operation, which may be excluded in this case for the fracture was closely reduced and stabilized with retrograde nailing instead of open manipulation. Although closed reduction may promote fracture healing with less surgical trauma, considering the sharp bony edge and the corresponding defected arterial wall found during exploration, various etiologies, including the initial traumatic mechanism, the input of the fracture movement, and suboptimal surgical reduction, still contribute to the vascular lesion with delayed presentation. Our case indicates the downside of noncontainment of fracture fragments during manipulation, especially the presence of sharp edges as well as surrounding vital neurovascular structures, which should not be overlooked.

The time to detect traumatic pseudoaneurysm varies from hours to years [2,7,10] depending on the involved regions and the symptoms and signs manifested. Clinical manifestations include an enlarging pulsatile swelling, audible bruit, palpable thrill, pain, edema, and compressive neuropathy. Without evident trauma history, the lesion may mimic some soft tissue pathologies like abscesses or neoplasms. Because of the presence of heat and tenderness in the surrounding area, the inflammation during hematoma organization may appear as a postoperative infection [6].

Formerly, angiography was the recommended technique for the determination of various vascular lesions. In the present case, although a simple noninvasive modality—duplex Doppler ultrasonography—provides immediate and initial screening, a less invasive recently developed multislice computed tomography (MSCT) angiography was used for definite diagnosis and comprehensive evaluation, including the identification of the damaged vessel, defected site, the involved extent, and status of collateral circulation. Using MSCT angiography, immediate data acquisition and processing is possible and arterial puncture or catheterization in traditional techniques can be avoided. A recent systematic review reported that MSCT angiography has high diagnostic value and is a reliable alternative to digital subtraction angiography in peripheral arterial diseases [11].

The management of pseudoaneurysms depends mostly on their location and size. For small asymptomatic lesions or those involving noncritical vessels, it may simply be observed 4—6 weeks for possible spontaneous recovery; however, interventions are generally indicated in larger ($>$3 cm) symptomatic lesions or vital vasculature involved. Current therapeutic modalities include open surgical repair, ultrasound-guided compression, ultrasound-guided thrombin injection (USGTI), and endovascular repair using coil embolization or stent-graft insertion [12]. In complicated cases, surgical intervention remains the standard treatment; however, once difficult exploration within the swollen soft tissues and the ongoing bleeding made other less invasive methods as mentioned more attractive alternatives. Owers et al. [3] reported two cases of arterial injury after femoral fracture, both being managed transcatheter embolization after unsuccessful surgical exploration.

Among the ultrasound-guided modalities, USGTI is reported to be highly successful (93—100%) and is superior to ultrasound-guided compression in terms of procedure time, patient satisfaction, recurrence, and complication rate (0—4%) [12]. The USGTI has been recommended as the therapy for choice because of the high-success rate, yet there are still some limitations. The relative contraindications include false aneurysms with short and wide necks endangering the downstream embolization and deeply located lesions inaccessible to accurate injection, which necessitate the intervention of vascular radiology. Advantages including immediate isolation of the psuedoaneurysm,

minimal blood loss, short procedure time, reduced hospital stay, and mortality are also maintained in the endovascular approaches [8]. In this case, an endovascular exclusion by a stent graft was chosen to solve the developing extensive swelling which precluded easy surgical accesses. This device provided possible alternative for rapid hemodynamic stabilization, although we were aware of the possible complications like device migration, residual leak, and the long-term stent patency [6].

Although critics were concerned about the necessity of the staged intervention, the fate of the thrombosed aneurysm is not clearly understood and endovascular stent graft alone may not relieve the compressive symptoms by the aneurysm [8]. The sequential surgical debridement was taken in our case to excise the massive symptomatic hematoma, which solves progressive neurovascular compression and possible closed-spaced infection after endovascular exclusion [13]. To our knowledge, there are a few publications describing the successful treatments with staged interventions in certain scenarios [14,15], acting as a less invasive viable alternative to open surgeries. Also, for a massive vascular lesion like our case, the hybrid procedures prove to be as effective as the traditional approaches without major operative risks requiring proximal and distal vessel control, although we acknowledge staged interventions are not indicated in all cases. Further studies in larger patient cohorts are needed.

In conclusion, we present a rare posttraumatic pseudoaneurysm of SFA successfully managed with staged interventions. Some traumatic vascular lesions are often detected late because of their insidious onset and variable clinical presentation. However, a progressive swelling around the fracture site or at the level of the implanted devices should raise clinical suspicion, and prompt investigation is warranted. Current less invasive modalities not only change the priority of treatment options but also facilitate the following surgical intervention with effective and rapid hemodynamic stabilization.

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